Mathematics 215 (3 credits) **Elementary Differential Equations I** Term 2 (2008/09)
Pre-requisite: Mathematics 101 (integral calculus) or equivalent
Co-requisites: Mathematics 200 (multivariable calculus) or equivalent; Mathematics 221 (linear algebra) or equivalent
Textbook: Boyce & DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 9th Edition (2008) or 8th Edition (2005). ***In the Course Outline, references are given to the 9th Edition (corresponding changes in the 8th Edition indicated in brackets).***
Location and times: MWF 10:00am, Room: Buchanan 104.
Instructor: George Bluman, Math Annex 1112, bluman@math.ubc.ca
Office Hours: by appointment. You can also try to drop-in.
Problem Assignments: due each week ***at the beginning*** of the Friday class.
Midterms: There will be two in-class midterms tentatively scheduled to be held on Feb 25 (Wed) based on Weeks 1-5, March 25 (Wed) based on Weeks 6-9.
Grading: 50% from the Midterms + homework assignments; 50% from the Final Exam. ***You must pass the Final Exam to pass the course! No notes, books or calculators will be allowed for in-class midterms or the Final Exam.***

COURSE OUTLINE—tentative

I. Introduction

1. Week of January 5: what is a DE, order, linear and nonlinear, solution, general solution, particular solution
Reading: Chapter 1.
Suggested Problems: p.15: 1(a), 3, 4, 8, 13, 15, 17, 18; p.24: 18, 20.

II. First order equations

1. Week of January 5 cont'd: solution of linear ODE, direction field
Reading: 2.1
Problems: p.39: 5, 11, 14, 21, 24, 32.
2. Week of January 12: existence and uniqueness, integrating factors, separable equations, symmetry, homogeneous equations, applications
Reading: 2.4, 2.6, 2.2, 2.3, 2.5
Suggested Problems: p.75: 3, 25, 27; p.99: 13; p.47: 1, 6, 30, 34; p.59: 8, 9, 10, 16, 18, 32; p.88: 15, 20, 22, 24 , 28.

III. Second order linear equations

3. Week of January 19: linear operator, existence and uniqueness, linear independence, linear homogeneous equation, linear nonhomogeneous equation
Reading: 3.1, 3.2.
Suggested Problems: p.144(142): 1, 9, 13, 17, 23, 28; p.155(151): 1, 2, 46(33), 51(38).
4. Week of January 26: Wronskians and linear independence (fundamental set of solutions), constant coefficient linear homogeneous equations (characteristic equation: real roots, double roots, complex roots), linear nonhomogeneous equation (method of undetermined coefficients when the homogeneous equations has constant coefficients)
Reading: 3.2-3.5(3.2-3.6)
Suggested Problems: p.163(164): 2, 7, 17, 25, 29, 32, 34(38); p.171(172): 1, 14, 23; p.183(184): 1, 8, 17, 28, 29.

5. Week of February 2: linear nonhomogeneous equation (method of variation of parameters), applications to electrical circuits and mechanical vibrations
Reading: 3.6-3.8(3.7-3.9)
Suggested Problems: p.189(190): 1, 5, 19, 21, 28, 29; p.202(203): 5, 15, 16, 19, 20, 30; p.215(214): 1, 5, 17.

IV. The Laplace transform

6. Week of February 9: definition and examples, solution of initial value problems, discontinuous functions
Reading: 6.1-6.4
Suggested Problems: p.311(312): 5, 6, 14, 18, 26, 27; p.320(322): 2, 11, 20, 24, 27(a,b), 28, 30, 37; p.328(329): 13(7), 25(19), 29(23), 30(24), 33(27), 34(28); p.336(337): 1, 10, 19.
7. Week of February 23: ***midterm #1 on Wed, Feb 25th.*** Impulse functions, convolutions.
Reading: 6.5, 6.6
Suggested Problems: p.343(344): 1, 25; p.350(351): 1, 7, 13, 21, 22, 29.

V. Systems of first order linear equations

8. Week of March 2: homogeneous case
Reading: 7.5, 7.6, 7.8
Suggested Problems: p.398: 1, 15, 29, 32, 33; p.409(410): 1, 26, 28; p.428: 1.
9. Week of March 9: nonhomogeneous case
Reading: 7.9
Suggested Problems: p.439: 1, 3.

VI. Nonlinear systems

9. Week of March 9 cont'd: introduction.
Reading: 9.1, 9.2
Suggested Problems: p.494(492): 1(a-c), 17, 20, 21; p.506(501): 1, 3, 17, 21, 23.
10. Week of March 16: example of simple pendulum, critical points, linearization, physical examples
Reading: 9.3-9.5
Suggested Problems: p.516(511): 1-6, 19(17), 21(19), 22(20), 27(25).

VII. Numerical solutions to initial value problems

11. Week of March 23: ***midterm #2 on Wed, Mar 25th.*** Euler's method.
Reading: 8.1
Suggested Problems: p.451(449): 1, 18, 25.
12. Week of March 30: other methods
Reading: 8.2-8.4
Suggested Problems: p.458(456): 1, 14; p.463(461): 1; p.469(467): 1.

VIII. Catch-up? and/or review?

13. Week of April 6: may be used for lectures to catch-up on schedule—otherwise for review